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U. S. Army Chemical Corps Research and Development Command
U. S. ARMY BIOLOGICAL WARFARE LABORATORIES
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Registration of the Respiratory Movements of Man by Means of a Thermobattery During Physical Exertion.

by B. A. Alpat'yev and I. N. Kondrat'yeva (Moscow).

Translated from Byulleten' Eksperimental'noy Biologii i Meditsiny (USSR), 24: 9: 129-130, 1959.

The recording of a man's breathing during physical exercise presents well-known difficulties, inasmuch as when using pneumatic, carbon-powder, or piezoelectric devices there occurs a mechanical distortion of the resultant curve.

There are data in the literature concerning registration of breathing in rabbits by means of a thermobattery actuated by the difference in temperature between the exhalation and the atmosphere. In registering respiration by this method, the thermobattery is attached to the animal's nose by means of a small rubber mask. Such a method does not entail any external resistance to the respiratory act.

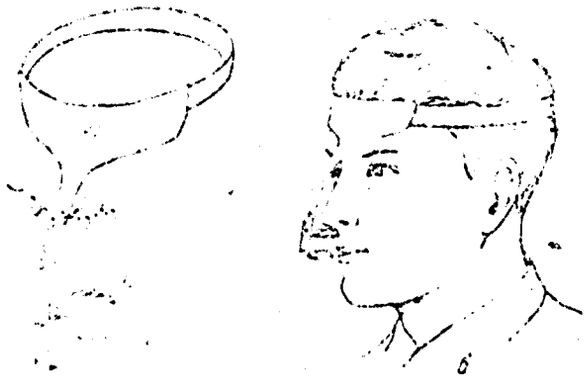
To use this principle in registering the respiratory movements in man during physical exertion, we introduced some changes in the construction and in the method of attaching the device that had been used on the rabbits.

The method consists of the following (fig 1). A T-shaped bracket (K_p), which is made of half-millimeter aluminum stock, is secured to the subject's forehead by an elastic band. On the lower part of the bracket, opposite the mouth and nostrils, are attached plastic frames (P_1 and P_2). On the frames are stretched copper-constantan thermocouples that are connected in series to the battery so that the junctions (actuating) Cn_1, alone, are opposite the nostrils and mouth, and the other corresponding junctions (Cn_2) are collected in one spot, a few centimeters above, where they are unaffected by the exhaled streams of air.

Because of the difference between the temperatures of the exhalation and the atmosphere, there is created within the thermobattery an electrical voltage that is transmitted through an amplifier to a self recorder. For this we used the functional diagnostic device 4-PFD-7 of the experimental shop of the VNIIMI and O (The All-Union Scientific Research Institute of Medical Instruments and Equipment) of the Ministry of Public Health of the USSR.

For comparison purposes recordings of breathing made simultaneously on a man performing physical exercise (raising and lowering a 6 kg weight with a bending of the back) are shown in Fig 2. One registration was made through use of the thermobattery, the other by means of the piezoelectric device.

As seen from fig 2 the working movements do not distort the precision of the respirational recording made with the thermobattery; in the recording made with the piezoelectric device fastened to the abdomen, however, there is reflected, in the main, the mechanical fluctuations in the rhythm of the work.



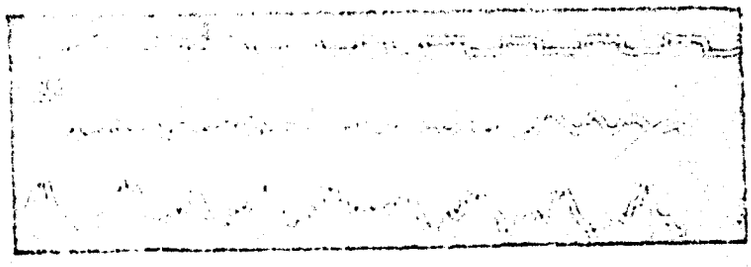


Fig 1. (a) A drawing of the device used to record the respiration of man by means of a thermobattery, and (b) the method of attachment.

Fig 2. Simultaneous respiratory recordings made by ~~the thermobattery, and by the~~ were also means of a piezoelectric device during physical exercise.

Designation of the curves (from top to bottom): the rhythm of the physical exercise; the respiratory recording made by means of the thermobattery; the respiratory recording by means of the piezoelectric device.